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Progress on in-vessel poloidal field coils optimization design for alternative divertor configuration studies on the EAST tokamak

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An upgrade to the lower divertor is currently being planned for EAST superconducting tokamak, aiming at >400s long-pulse H-mode operations with a full metal wall and a divertor heat load of ~10MW/m2. A new divertor concept for EAST, “Tightly Baffled Divertor”, suited to water-cooled W/Cu plasma face components (PFCs) with minimized divertor volume, has been proposed to achieve Te,target<5eV across entire outer target at lower separatrix plasma density and optimized pumping by a simple closed divertor structure combining horizontal target with inclined baffle, dome and duct. This divertor should allow access to high-triangularity small-ELM H-mode regimes and also allow achieving Snowflake or X-Divertor like configurations with the assistance of two water-cooled in-vessel divertor coils (DCs). Preliminary engineering design of in-vessel DCs indicates a maximum current of 8kAt for long-pulse discharges, and 20kAt for the shortest ones. However, flexibility on DCs position optimization is limited to the water cooling system. Initial plasma equilibrium studies by FIXFREE code, used in combination with CREATE-NL and EFIT tools, show that the distance of the two nearby divertor poloidal field nulls, can be decreased up to ~0.8m with a plasma current IP~400kA, leading to a configuration with the secondary x-point located between the primary x-point and the target or close to the target, with a significant increase of magnetic poloidal flux expansion and connection length. This may provide a promising divertor solution compatible with advanced steady-state core scenarios.

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